DOCUMENT RESUME

ED 257 294 EC 172 722

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TITLE Impedance in School Screening Programs.
PUB DATE Apr 85
NOTE 4p.; Paper presented at the Annual Convention of the Council for Exceptional Children (63rd, Anaheim, CA, April 15-19, 1985).
PUB TYPE Speeches/Conference Papers (150) -- Viewpoints (120) -- Journal Articles (080)
JOURNAL CIT Hearing Instruments; v34 n2 p8,12-13 1983

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Audiometric Tests; Auditory Evaluation; *Elementary Education; Handicap Identification; *Hearing Impairments; *Screening Tests
IDENTIFIERS *Impedance Audiometry

ABSTRACT

This paper examines the controversy over use of impedance screening in public schools to identify students with hearing problems, including otitis media, a common ear condition in infants and young children. It cites research that questions the value of pure tone screening as a single test and raises critics' objections to the use of impedance, including over-referral and methodological weaknesses in studies linking conductive hearing impairment to learning and language problems. The inclusion of impedance screening with pure tone audiometry would lead to a more effective screening battery, identifying children with problems that may be prevented. (CL)

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Impedance in school screening programs

By John T. Robarts

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During the late 1960's, I worked in a conservative school system that allowed, because of the social pressures of the time, the development of an alternative high school. However, they placed stringent requirements on the program, hiring outsiders to completely evaluate the program and to compare it with the traditional high school. The results of the evaluation showed that the students at the alternative school did significantly better than the regular program students in achievement and attitudes toward self and school and, furthermore, did very well in their post school placements.

Given this knowledge, the school board begrudgingly conceded that the alternative school could continue. It never occurred to them, however, that perhaps the evaluation raised some issues about the traditional high school.

This anecdote reminds me very much of the current debate over whether a combined screening battery of pure tone audiometry and impedance testing should replace the traditonal method of doing pure tone audiometry alone.

It seems that many of the critics of inclusion of impedance screening appear to be captives of their "ivory towers" in their desire for hard research. It might be instructive to look at the statement of the Conference on Identification Audiometry, held in Baltimore in 1961. The conference defined the objectives of the hearing screening program: "The goal is to locate children who have even minimal hearing problems so that they can be referred for medical treatment of any active ear pathology discovered to be present and so that remedial educational procedures can be instituted at the earliest possible date...The purpose of the audiometric test is to lead to the final identification of those who should be referred to an otologist or other physician for a complete diagnostic workup."[7]

Guy Lescouflair, in his 1975 essay, "Critical View on Audiometric Screening in School," expounded on that concept: "I think that a complete reassessment of hearing screening programs as their name implies, are conceived only to discover hearing loss, whereas an effective program should not be one of screening, but one of total prevention: this difference is actually the core of the whole problem."[7] It seems to me that it is time to step back from the question of whether or not impedance screening has any flaws and to re-examine the rationale for the combined battery. The question is does pure tone screening adequately meet the criteria stated above by the 1961 Conference on Identification Audiometry and further expanded by Lescouflair?

Countless studies have questioned the value of pure tone screening as a single test for meeting these goals. At one extreme, we have the view of Dr. Richard Winchester, director of the Div. of Communication Disorders, Children's Hospital for Philadelphia. He stated it at a 1974 symposium: "At least 90% of the hearing problems met in a school-age population are related to minor, nonpainful, non-draining cases of otitis media causing a 15 to 20 dB hearing loss which would pass the ordinary school hearing tests."[10]

Brooks gave a detailed breakdown as to why pure tone testing is ineffective: high ambient noise levels in most schools: the subjectivity of pure tone testing poses a major problem; the uncontrolled effect in the skill of the tester and degree of rapport obtained with the child being tested; this complex task involves many non-auditory factors such as motivation, attention and intellectual maturity; and the unjustifiably high demands made upon a child by the above factors.[10]

These factors make it obvious that pure tone testing alone, except under the most controlled testing conditions (seldom obtainable in screening programs), misses a significant number of children whose problems lend themselves to treatment and thus prevention of further problems.

Why, then, do the critics say that the combined battery should not be used? Perhaps the most formal statement of the position came from the task force working at a national symposium in June 1977 at the Vanderbilt U School of Medicine, Nashville, TN. They specifically stated that impedance measurements should not be applied for universal (mass) screening on a routine basis for the detection of middle ear disorders in children in any age group.[1]

A substantial minority of that task force membership disagreed with the findings. They said in a letter to Corti's Organ in July 1978: "...the final recommendations clearly demonstrated the old adage that, ... 'a camel is the result of a committee trying to design a horse'."[4]

They added that the task force recommendation not to do impedance screening was "...a blatant contradiction when one considers that the task force report also states that middle ear effusions are a prevalent condition among infants and children, and that evidence exists that early treatment may be of advantage in preventing certain unfavorable long-term developmental consequences in some children."[4]

The dissenters concluded: "The recommendations are phrased in such a way as to act as a deterrant to the early identification and management of this prevalent disease. It is incongruous that a set of referral criteria and other guidelines for impedance screening are presented by the task force, but at the same time identification by impedance screening is explicitly discouraged. It is our contention that this position has been taken, not because the impedance screening procedure lacks validity, but because there is considerable uncertainty about medical management of the identified pathologic condition."[4]

Generally speaking, the critics of the inclusion of impedance screening in a combined battery do not assail the validity of impedance screening as a diagnostic tool. The high positive correlations between impedance testing and pneumatic otoscopy seem to have resolved this question.

Indeed, one of the questions that has been raised is whether or not the technology available to do screening has outdistanced the ability of the referral sources to handle the information. Jerry Northern, PhD, addresses that issue in a recent paper. He says, "The technology for evaluating conditions of the middle ear has apparently exceeded our current abilities to manage middle ear problems.

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The fact that physicians in some communities are not skilled in the diagnosis and management of otitis media with effusion is not the fault of impedance screening. It is likely that impedance information will help physicians reach objective decisions about the middle ear status of patients. Impedance measurements have already stimulated research efforts, provided improved management information, while educating physicians to improve their diagnostic and medical acumen. The practicality and important contribution of impedance screening to community programs cannot be denied."[8]

Other critics of the inclusion of impedance screening cite the fact that there is very little valid data linking conductive hearing impairment to learning problems, language dysfunction or central auditory problems. These complaints about the research are best stated by Ira M. Ventry in his article "Effects of Conductive Hearing Loss: Fact or Fiction." Ventry points out flaws in most of the research tying conductive hearing loss to learning problems.[12]

But the type of blind study that might prove a connection would be all but impossible to conduct in our society. It is difficult to imagine a school system or a public health program that would be able to identify children, and then only refer and treat selected ones while monitoring and comparing their development with that of the control group.

However, there are significant studies, most retrospective and usually involving small samples and fewer controls. And to back them up, there is a large body of anecdotal and incidental data that emerges from discussions of the connection between conductive loss and learning problems. I have many opportunities to speak with elementary teachers and special educators in regard to these problems. While unfamiliar with the research, they recognize the symptoms and they respond to the "ah hah" experience with a new interest. These specialists know that they have seen this same phenomenon in their children, but that they did not have the technical terms to explain the problem.

Ruben and Hanson commented on the same phenomenon in their introduction to a 1979 workshop: "Health care professionals who deal with children are familiar with the picture of the child who has required frequent treatment for middle ear disease. Typically, concerned parents present their boy or girl who seems inattentive at home and at school. The child may have been treated almost continuously with antibiotics and decongestants for middle ear problems with no real improvement. Finally, after failure of medical treatment, the decision is made to have ventilation tubes placed. Very often the parents and teachers comment afterwards on the remarkable improvement in the child's attitude and performance at home and in school. An audiogram confirms that hearing loss returned to normal, yet it is difficult to imagine that a relatively small degree of hearing loss could make such a difference. Anecdotal experiences similar to this are not uncommon."[11]

New information about the relationship is continually coming to light. One study by Zinkus, et al, pointed out the link between middle ear problems and learning problems.[13] Another recent study, which actually had nothing to do with impedance screening, talked about the relationship between normal and minimal hearing loss students in intellectual and academic performance. This was done as part of Project MARRS (Mainstream: AmplificationResource Room Study), a Title IV-C study that drew some rather interesting conclusions: "...students having minimal hearing loss also have significantly lower Verbal and Full Scale IQ scores than do the normal hearing population. However, they also have significantly lower Performance IQ scores as determined by the WISC-R (Weschler Intelligence Scale for Children-Revised)." They add: "Furthermore, learning disabled students with a minimal hearing loss have lower verbal, performance and full-scale IQ scores than do their normal hearing counterparts as determined by the WISC-R."[2]

In other words, not only did they find the expected difference between students with normal hearing and students with minimal hearing loss, but even within the learning disabled population, they found a difference between students with minimal hearing loss, and those learning disabled students with normal hearing.

Perhaps some hard research will emerge from the studies now going on with children with a high incidence of middle ear problems. These children have been given amplification and other assistance from birth and their progress is being closely monitored.

If we look holistically at the problem, there seems to be emerging evidence that otitis media has a direct relationship to learning problems. And the medical profession is finding new tools and techniques for managing the problems. There is an excellent discussion of this view in "The Changing Challenge of Otitis Media" by Donald Radcliffe.[9] In reporting on a briefing for medical editors done by Charles D. Bluestone, MD, Jerome O. Klein, MD, and John D. Nelson, MD, Radcliffe summarized: "They believe more importance should be attached to the disease itself, because the potential disability from this very common disease affects so many children so often. Hearing loss is the most common and serious complication of this disease. Effusion in the middle ear almost always causes some degree of hearing impairment." He notes "recently discussed studies suggest that middle ear disease occurring in the first years of life may have adverse effects on the development of speech and language, hearing, intelligence and performance in school."[9]

Based on what seems to be very convincing, if not empirical information, the case is clear for the inclusion of impedance screening with pure tone audiometry to make a more effective hearing screening battery. If one assumes that this is correct, that leaves two other commonly cited reasons for not including impedance screening. The first is the over-referral problem. There is no question that certain aspects of impedance testing tend to lead to what can be termed as over-referrals. There seems to be little debate in the field about referrals involving situations where there is both negative pressure and low compliance (B shaped curve or flat tympanogram). The major debate focuses on whether or not children who only exhibit negative pressure should be referred. Strict adherence to the guidelines that came out of the National Symposium and from ASHA recommendations, plus a discussion between the testers and the treaters in a given community can eliminate the problems. Most would recommend that these children not be referred until they have been tested and then retested four to six weeks later. It is still possible that these ears will not be found to have fluid.

Nevertheless, the physician, at this point, may decide that it is important to investigate root causes, to seek the factor blocking the Eustachian tube, be it tonsils, adenoids or allergies. The doctor looks to see if the situation for this child is chronic and if it requires further evaluation. Working together on pre-determined referral criteria, with a willingness to evaluate and consider different options, should minimize the over-referral problems.

It is most important that receivers of the referrals support the screening program. Obviously, any good screening program is going to have some over-referrals; a program without them is very likely to be under-referring. When we are dealing with a preventable cause of learning disabilities, under-referrals loom as the real threat to prevention.

The discussion of over-referrals leads to the final concern of the critics of impedance screening, that of cost. Cooper found in his study that the use of the combined battery is no more costly and perhaps even more cost effective than the use of pure tone alone.[3] With the new equipment available, and with appropriate training for testers, the combined battery is more effective but no more expensive.

Whereas pure tone screening typically refers 3 to 5% of the children, we have found that the combined battery

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refers 16 to 18% for those children up to the age of nine. With the screening of over 50,000 children in the past three years, the confirmation of these problems has been 88%.[6] This compares with 79% reported in the literature for pure tone only.

Thus, we can see that the combined battery will refer many more children than would pure tone alone. It will help to identify those children with problems that we hope to prevent, and it will do so with a minimum of over-referrals. And because it is a combined battery, one does not need to do the traditional full range of pure tone screening. Specifically, one need not do the low frequencies, which are most influenced by ambient noise. Practically all low frequency losses are conductive losses caused by middle ear problems and would be better identified by impedance. Thus, one only needs to screen at the higher frequencies in order to identify sensorineural loss. (In our program we recommend 2000 and 4000 Hz at 25 dB. Some programs also include 1000 Hz and, depending on conditions, may try to screen at 20 dB as opposed to 25 dB.) This article does not mean to imply in any way that further research into impedance screening is not necessary. Indeed, it is very necessary. We also need further research on the medical management of otitis media, as well as a particular focus on the educational treatment of children with chronic otitis media. It is important to give the best available tools to those doing the screening.

In 1976, at the Third International Symposium on Impedance Audiometry, Dr. Gilbert Herer, of the Children's Hospital, Washington, predicted that: "...impedance audiometry will do the greatest good for the greatest number in the hands of primary health care providers and personnel conducting large scale health screening and hearing conservation programs...It will identify greater numbers of children in need of help than can be accomplished by present procedures. The effective use of impedance audiometry by these two service delivery systems, coupled with appropriate medical management of the child, could avert language delay in a number of pre-school children and educational problems for many children of school age...and thus significantly influence their quality of life."[4] □

This article is reprinted from "Speaking of Hearing."

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Paper presented at the Annual Convention

of the

Council for Exceptional Children

(63rd, Anaheim, CA, April 15-19, 1985)

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